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Judith Olivia Canipe
jcanipe3@utk.edu

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Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

**Testing the Marshall-Lerner-Robinson Condition
in Ghana prior to 1983: Was a devaluation of the
cedi justified in improving the trade balance?**

A Thesis Presented for the
Master of Arts
Degree
The University of Tennessee, Knoxville

Judith Olivia Canipe
December 2012

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ABSTRACT

The aim of this paper is to empirically predict the quantitative impact of a devaluation of the Ghanaian Cedi on the trade account for 1960 to 1983. The imperfect substitutes model is employed to test the Marshall-Lerner-Robinson condition. In doing so, conclusions are drawn about the World Bank's implementation of loan conditionalities requiring a devaluation in order to address the trade deficit. Similarities between the economic structure of Ghana and other less developed countries allow for an extension of this study to other countries considering depreciation policies. The effect of a currency devaluation on the cocoa industry is also discussed. OLS and panel regressions conclude that the Marshall-Lerner-Robinson condition does not hold, implying a devaluation would lead to worsening the trade account. The Prais-Winsten procedure is applied to address potential autocorrelation. This result is supported by the trade account data in the decade following this devaluation. These results are in agreeance with relative literature suggesting that an economy with high import dependency will not see an appreciative trade balance following a currency devaluation. It also supports the theory that a concentration of exports in a few primary commodities will see low export price elasticities. However, the extent of the trade deficit's consistent widening may be exaggerated by the consecutive currency devaluations that followed.

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CHAPTER I

INTRODUCTION

This paper examines the decision to devalue the Ghanaian cedi in 1983 and the ramifications to the nation's trade balance following this policy implementation. This introduction will discuss the contribution of this study to the literature, as well as the history and intervention of the World Bank and International Monetary Fund (IMF) in Ghana. This intervention involved not only financial assistance, but also encouraged policy adjustments that would improve institutions, benefit the trade balance and promote economic growth. The major contribution of this paper lies in its examination of the import and export aspects that are unique to Ghana, and how those influence the estimated price elasticities. This allows for an analysis of how this exchange rate manipulation led to ramifications affecting the trade balance in Ghana. The World Bank and IMF intervened in 1983, offering numerous loans subject to conditions that aimed to improve the trade environment in Ghana. Commonalities between Ghana's trade structure and other African countries suggest potentially similar outcomes for these nations considering currency devaluation.

1.1 Contributions of this study

This paper will investigate the potential for improvement in the trade balance prior to a devaluation. The purpose of this is two-fold. First, it is of interest to determine whether the decision to devalue the cedi in 1983 can be

justified by the Marshall-Lerner-Robinson condition. This condition sums price elasticities to determine if a currency devaluation will improve the balance of trade. If the price elasticities sum to greater than 1, the condition predicts a devaluation will be beneficial to the trade balance. Secondly, the characteristics of the Ghanaian economy that are unique to other developing countries will give some indication as to which nations are most likely to meet this condition and should consider depreciation as a means to improving the trade balance. It also provides insight into the more common trend of a consistently worsening trade deficit in these developing nations.

Although a large amount of literature has examined the relationship between exchange rate movements and fluctuations in the trade balance, these studies have focused primarily on movements in the trade balance following a devaluation. This retrospective literature is commonly known as J-curve literature, named for the typical path traced by the trade balance following a currency devaluation. The majority of the J-curve literature has resulted in conflicting conclusions about whether the nominal or real exchange rate has any significant impact on the balance of trade. This ambiguity often exists in differences between developed and less developed countries, as well as the extent of import reliance and the composition of exports prior to a devaluation.

This paper will investigate the trade account from a forward-looking perspective by predicting whether the trade balance would be improved by a currency depreciation prior to implementing exchange rate policy. Similar studies that aim to evaluate exchange rate ramifications to the trade balance use a

variety of theoretical and empirical techniques. This study will employ the Marshall-Lerner-Robinson condition, estimated by the imperfect substitutes model to forecast the effect of a currency depreciation in 1983 on the trade balance in Ghana. The time period of interest in this study is 1960-1983. This is the period prior to the first of a series of currency devaluations and structural adjustment policy implementations that were initiated in 1983.

1.2 World Bank and IMF Intervention

In 1983, with Ghana's inflation at a high of 123% and GDP growth at -5%, the World Bank initiated an Economic Reform Programme. This intervention involved structural adjustment policies aiming to address these, as well as other macroeconomic issues, including a reduction of the trade deficit. The primary component of the deficit reduction process would be to enhance exports. From 1983-1999, 26 loans, subject to various conditions, were provided to Ghana. Following this initial involvement in 1983, GDP growth has been consistently positive, and Ghana has seen significant export growth. Following improvements over this time period, Ghana has commonly been deemed a great success of the World Bank. However, over this period of adjustment, currency devaluation remained a primary focus of reform. The intention of these devaluations was consistently aiming to improve export performance. Specifically, as the cocoa industry was a primary concern, these policies were intended to greatly improve hindrances related to pricing, smuggling and production of cocoa. Since cocoa is

the most significant source of exports for the Ghanaian economy, the trade balance was believed to be heavily influenced by this industry.

Major conditionalities attached to loans included export sector reforms, particularly in agriculture, and an adjustment of the cedi. These specific policies are of greatest interest, as this paper will examine the balance of trade and specifically the impact of cocoa. It was believed that a primary issue with the export sector was an overvaluation of the cedi, making Ghanaian products relatively more expensive than those of their competitors. Therefore, a plan was implemented to devalue the cedi and gradually move to a floating exchange rate regime. Another motivation for this exchange rate policy was the issue of smuggled goods to bordering countries, particularly the Ivory Coast, due to overpricing. An adjustment of the exchange rate was thought to lessen the magnitude of smuggling, particularly of cocoa, as the export market would improve in Ghana and reduce the incentive for smuggling.

CHAPTER II LITERATURE REVIEW

Here, I will conduct a brief review of the literature most relevant to the modeling structure, estimation techniques, and data employed in this paper. There exists a wide variety of literature that estimates trade price elasticities. The studies differ by empirical methodology, as well as the geographic area, time period, and specific elasticities of interest. The level of aggregation in trade elasticities can range from measures of total imports and exports to a single good or commodity. Studies also differ based on the number of chosen trading partners. Some literature employs data from all trading partners and others look at trade simply on a bilateral basis in their estimations. Issues with the availability of data make it most common to look at trade either on a bilateral basis or for a few of the top trading partners for a particular nation. Most relevant literature applies one of two popular modeling techniques: a production function approach (see Kohli 1991) and the "imperfect substitutes" model developed by Goldstein and Kahn (1985). Both models can be applied to aggregate import and export demand functions or modified to estimate elasticities at a more disaggregated level. These models are also often used in studies aiming to estimate income elasticities of trade.

A subsection of this literature employs the Marshall-Lerner-Robinson condition in order to relate the price elasticities to the implications of a devaluation on the trade balance. There is a vast availability of literature examining the effect of the exchange rate on the trade balance. Although it has

generally been assumed that a depreciation will improve the trade account, a direct linkage between the exchange rate and trade balance remains debatable.

2.1 Significant Exchange Rate Literature

Rose (1991) conducted one of the major studies with evidence against this theory that there exists a causal relationship between the exchange rate and trade balance. Rose applies the imperfect substitutes model to examine the role of exchange rates on the trade balance for five major OECD countries in the short, medium, and long-run. His results find no support for an exchange rate effect on the trade balance in the short-run, and very little evidence for a linkage in medium and long-run estimates. Literature finding support for a causal relationship between the exchange rate and trade balance tends to have similar results, in that a long term relationship is more prevalent than short term. Multiple studies, including Marwah and Klein (1996), have examined the time length necessary to observe an improvement in the trade account following a currency depreciation. These results have ranged from a time period of three months to two years. However, most estimates are typically less than two years.

The United States and members of the European Union are among the most popular of estimated trade elasticities in the literature. These estimates for the United States, European Union and other developed nations, often differ greatly from less developed or developing nations. At the aggregate level, this has been credited to import dependency differences as well as geographic size,

see Tokarick 2010. However, these estimates also vary greatly as elasticities are examined on a more disaggregated basis.

Reinhart (1994) conducted a study of aggregate trade flows for twelve developing nations, and finds significant evidence for relative prices having an impact on the trade balance. However, another result of this study is that price elasticities of imports and exports tend to be low, and in most cases, well below unity for developing nations. In most cases, the Marshall-Lerner-Robinson condition is not satisfied. In regards to this result, Reinhart concludes that a relatively large depreciation of the exchange rate would be necessary in order to see an improvement in the balance of trade. Reinhart also shows that the large commodity content of African exports is a major influence in lowering the elasticities in these economies.

With respect to country-specific studies, the most relevant literature to Ghana is a study by Kulkarni (2011), in which he employs annual data to modify the J-curve hypothesis and evaluates shifts of the curve to test the Marshall-Lerner-Robinson condition. Following each currency devaluation, this hypothesis predicts that a trade balance will worsen in the short run, before showing consistent improvements thereafter. This pattern leads to the shape plotted by movements in the trade balance over time. Kulkarni concludes that continuous devaluations can lead to a consistently worsening balance of trade. This would imply that the failure of the trade balance to improve following a currency devaluation may result from a lack of time for adjustment between devaluations. Therefore, in order to test the Marshall-Lerner-Robinson condition for Ghana,

elasticity estimates prior to the initial devaluation in 1983 are more relevant.

Looking at the condition by way of the J-curve hypothesis following a depreciation is more difficult, as the path traced by the trade balance will be over a period of multiple devaluations, and would not be expected to follow the "J" pattern. Therefore, an analysis of the effects resulting from a single devaluation is less conclusive. Kulkarni also touches on the effect of the cocoa industry on exports. The initial concentration of agricultural export growth policies were on cocoa in 1983, as the crop accounted for an estimated 60% of exports. This proved to be beneficial, as exports of cocoa nearly doubled between 1983 and 1989. Kulkarni's results show that despite this export growth in cocoa, the overall trade balance consistently worsened. However, this could be due to the continuing devaluations that followed, or an import demand growth rate that increased faster than export growth.

Jones (2008) adapts the imperfect substitutes model to estimate only import price elasticities for ten African nations (excluding Ghana) during 1993-2004. These elasticities are estimated on an aggregate basis, as well as for various product groupings and sectors as defined by the Harmonised System. At the aggregate level, these long run African import elasticities are near unity. However, Jones concludes that import demand is more elastic in sectors that have relatively high levels of domestic production or where there are exports. His results also show that import demand is inelastic for sectors dominated by imports. The relevant literature has found Ghana to be heavily dependent on imports at an aggregate level, see Ahoritor and Adenutsi (2010). Therefore, with

this dependency, we would expect to see an inelastic estimate for import demand price elasticity at an aggregate level.

Loto (2011) tests the Marshall-Lerner-Robinson condition in Nigeria for 1986-2008. He concludes that a devaluation of the currency would only worsen the trade balance, given that the condition does not hold. He attributes this to the high level of import dependency in Nigeria and concludes that similarly structured economies would fail to satisfy the condition. His results suggest that because of Ghana's similar dependency on imports, a currency depreciation would only worsen the trade balance as the Marshall-Lerner-Robinson condition is not likely to be satisfied.

2.2 Low Price Elasticities in Developing Countries

A study conducted by Babatunde and Olofin (2009) estimate export elasticities for a group of Sub-Saharan African nations from 1980-2003 and find that export price elasticities are extremely low, ranging from $-.01$ to $-.17$. This study uses the imperfect substitutes model and finds the income elasticity to have a significantly greater effect on exports and imports than the price elasticity. This study results in income elasticities ranging from $.48$ to 1.30 . Babatunde and Olofin credit these very low price elasticities to the over-dependence of African nations on a very narrow range of primary commodities for their source of exports. In particular, Babatunde and Olofin cite these particular commodities as being of declining relative importance in world trade. Ghana fits this structure

over the time period of interest, particularly in its historical dependence on cocoa as its most significant source of exports.

Cruz (2008) relates low price elasticities of developing countries to the amount of capital-intensive and labor-intensive goods that are its primary exports. He concludes that if the economy under concern happens to be a labor intensive producer, then it tends to specialize in primary goods, whose terms of trade over time usually deteriorate against movement towards manufactured goods. His results show that the price and income elasticity of export demand for these goods are low. Ghana's primary agricultural industries are labor-intensive and follow this pattern of specialization in a select few primary goods. Cruz would suggest that as the economy develops and moves towards greater production of more capital-intensive goods, the export potential for these primary agricultural goods in Ghana would deteriorate.

Morrissey conducts a study of African nations' exports by examining their volume of exports rather than the value. He focuses on Uganda in particular, but finds that the typical African export is a commodity whose pricing is often out of the nation's control. In terms of the volume of exports, the price elasticity is -0.2 for the aggregate of African nations. The agricultural price elasticity is significantly lower, at -0.07 . These results, in conjunction with Babatunde and Olofin, suggest that concentrating exports in a few primary commodities from smaller developing economies that cannot affect the world price result in a very low price elasticity. This would appear to be the case for Ghana. Morrissey makes another significant conclusion regarding the impact of institutional quality

for export support. Without this institutional improvement and stability, policies oriented towards boosting trade will have minimal impacts. A majority of structural adjustment policies implemented in 1983 aimed to mend institutional problems of Ghana. Therefore, it is likely that with a wide variety of conditionalities making products more competitive, export improvement could stem from more than currency depreciation alone.

2.3 Cocoa Export Performance

In regards to cocoa trade, literature concentrates mostly on the export side of trade and distortions to trade policies and producer incentives. When looking at 1960-1983, it is apparent that smuggling and price distortions were the primary concerns regarding improvements of exports. There exists a wide variety of studies examining cocoa as the primary exporting industry of Ghana. Imports of cocoa into Ghana are negligible, and therefore are not of focus in the literature.

A study by Fosu (1992) related cocoa producer prices to the nominal exchange rate and found that a 10% devaluation of the cedi actually led to a 7.8% increase in the price of cocoa. This indirect inflationary effect dampens the effect of a currency devaluation as lower relative prices are not fully realized. Estimates for other agricultural goods also saw significant inflation rates when the cedi was devalued. Therefore, although currency depreciation is thought to increase exports, its potential to enhance inflationary pressures can dampen or even reverse export growth. Fosu also determines that a relatively high tax on

cocoa exporting producers between 1960-1987 hurt agricultural exports over this period.

Brooks, et al. (2007) states consistent state interventions and significant rents required from farmers by the Ghana Cocoa Board (COCOBOD) as being the most harmful factors to the cocoa industry up to the mid-1980s. As cocoa is the greatest source of exports for Ghana, institutional adjustments and removal of unnecessary rents and taxes may be the most significant factor in improvement of the cocoa industry. Without these modifications, addressing overpricing and overvaluation of the cedi will have a less significant impact on the cocoa sector.

CHAPTER III EMPIRICAL METHODOLOGY

3.1 Marshall-Lerner-Robinson Condition

The Marshall-Lerner-Robinson condition, also commonly credited to Bickerdike, was originally developed in 1920 and later discovered and altered independently by Lerner and Robinson. This condition uses a price elasticities of demand concept to evaluate the potential for an improvement in the balance of trade. This condition is commonly applied in literature that focuses on determining what the effect of a currency devaluation will have on the trade balance. It states that if the absolute value of the sum of price elasticities of import and export demands is greater than unity, then a depreciation of the currency will lead to an improvement in the trade balance. If the condition is not met, it is possible that devaluating the currency will worsen the trade balance. In this case income from exports may actually decline (in real terms, since the currency is weaker) as the cedi depreciates. Likewise, if Ghana's demand for imports is highly inelastic, then more expensive imports will only minimally affect Ghana's demand for imported goods. In this case expenditures on imports may actually rise as they become more expensive. Under these conditions, a depreciation of the currency will actually widen the trade deficit.

Stern (1973) provides the full derivation of the Marshall-Lerner-Robinson condition. The estimated magnitudes of these elasticities also give an indication of how much the demand for imports and exports will change following a

currency devaluation. Therefore, we can predict the level of improvement in the trade balance with these elasticities, given that the condition is met.

The Marshall-Lerner-Robinson condition assumes the economy is initially in a balanced state of trade. However, Brooks (1999) shows that this condition can still be examined when there is an initial trade deficit. Brooks also suggests that with an initial trade deficit, a currency devaluation may still improve the trade balance when the condition is not met. Since Ghana's trade balance is initially in a trade deficit over the period of interest, the Marshall-Lerner Robinson condition can still be applied to examine potential improvements in the trade balance.

Total trade for Ghana, as a percentage of GDP, was 12% in 1983, and had risen to 43% by 1990. However, during this period, imports increased substantially faster than exports. This difference in growth rates between imports and exports worsened the trade deficit in Ghana. With the exception of 1984, in which we see a one year reduction in the trade deficit, the trade balance consistently worsened. By the Marshall-Lerner- Robinson condition, if import and export demand price elasticities are not large enough (in absolute value), then the condition predicts a worsening trade balance following currency depreciation policies. Therefore, we would expect that the condition, as it applies to elasticities of aggregate exports and imports, was not met prior to the structural adjustment policies addressing nominal cedi devaluation.

The length of the trade adjustment period has been explored in multiple empirical studies and resulted in varying estimations. These estimates range from three quarters (Marwah and Klein, 1996) to two years (Shirvanni and

Wilbrette, 1997) before seeing an improvement in the trade balance. There exist other estimates within this range, but none longer than two years. Therefore, we would expect to see a reduction in the trade deficit by two years following a devaluation, in 1985, and then consistently after this benchmark, if the Marshall-Lerner-Robinson condition was met prior to a currency devaluation (see Table 1). Since the period following cedi depreciation shows worsening of the deficit, this paper will test the condition with the hypothesis that the import and export elasticities do not sum to greater than unity. Hence, the prediction is that the Marshall-Lerner-Robinson condition does not hold and that a depreciation of the cedi would not improve the export market enough to compensate for growth of imports.

Table 1. Trade balance following currency depreciation

Year	Imports (% of GDP)	Imports (US\$)	Exports (% of GDP)	Exports (US\$)	Trade Balance (US\$)
1982	3	816,900,000	3	710,891,088	-106,008,912
1983	6	634,400,000	6	477,300,000	-157,100,000
1984	11	696,000,000	8	609,700,000	-86,300,000
1985	14	836,400,000	11	670,400,000	-166,000,000
1986	20	975,850,000	17	804,130,000	-171,720,000
1987	26	1,200,800,000	20	905,500,000	-295,300,000
1988	24	1,261,400,000	18	957,700,000	-303,700,000
1989	24	1,287,500,000	17	889,100,000	-398,400,000
1990	26	1,505,500,000	17	983,200,000	-522,300,000
1991	26	1,655,052,000	17	1,100,500,000	-554,552,000

Source: World Bank DataBank

Import and export trends following 1983 can be found in Figure 2 of the appendix.

3.1.1 Application to the cocoa industry

With a heavy concentration of conditionalities focusing on the performance of the agricultural sector, and cocoa in particular, it is also of interest to examine this specific elasticity as it applies to the exports of cocoa. The cocoa industry has historically been the greatest source of exports for Ghana. Brooks et al. (2007) examines agricultural incentives in Ghana and cites smuggling agricultural goods, particularly cocoa, to the Ivory Coast and other bordering nations, as being one of the greatest losses of potential exports for Ghana. This issue with smuggling has been commonly blamed on an overvaluation of the cedi, making the commodity relatively more expensive when purchased in Ghana as opposed to the Ivory Coast. It was estimated that 20% of the crop was smuggled annually in the 1970s and early 1980s (Brooks et al., 2007). As cocoa has historically been Ghana's most significant agricultural crop, this level of smuggling had a significant impact on the amount of cocoa available for exports. This further dampened the potential for export growth to facilitate an improvement in the trade balance. Therefore, this paper will also estimate the export price elasticity of cocoa in order to predict the effects of a cedi devaluation on the market for cocoa in Ghana.

Brooks (1999) shows that the Marshall-Lerner-Robinson condition is not applicable when the initially a trade surplus. As the cocoa industry of Ghana has historically been in a surplus, and is over the time period of interest, this condition is not relevant. However, the imperfect substitutes model can still be applied to determine the potential for improvements in cocoa exports. This will allow for an

evaluation of how much a depreciation of the cedi will improve the value of cocoa exports. We would expect this elasticity to be of the greatest significance in determining whether there will be an improvement in the aggregate trade account, since it is the greatest source of exports for Ghana.

3.2 Imperfect Substitutes Model

The literature examining the Marshall-Lerner-Robinson condition typically employs a production function approach or elasticities approach. The elasticities approach uses one of two methods. The first, which will be adopted in this paper, is to directly estimate price elasticities from import and export demand equations. The second, more indirect method, involves looking at the reaction of the trade balance following the depreciation of currency over a certain period of time. This second method is commonly known as J-curve literature, due to the common path shaped by a changing trade balance following depreciation. This shape implies that the trade account will worsen temporarily before seeing a consistent improvement following a depreciation. The forward-looking nature of this paper rules out the use of the indirect method of examining post-depreciation patterns of the trade balance. Therefore, for the goal of predicting the impact on the trade balance prior to a devaluation of the currency, the first method of estimating import and export demand equations is preferred. This will allow for an application of the Marshall-Lerner-Robinson condition with these elasticity estimates.

In order to estimate price elasticities directly, import and export demand equations must be specified. Goldstein and Kahn (1985) provide two models, separated by the level of substitution between domestic goods and imports. The perfect substitutes model assumes foreign and domestic goods are perfect substitutes. Therefore, it predicts that a country will only participate in the export market or import market for a particular good, but not both. The perfect substitutes model then does not allow for a country to have simultaneous imports and exports of any given good. The second model presented as an alternative, is the imperfect substitutes model. This model assumes that foreign goods are imperfect substitutes for domestically produced goods. Therefore, this specification allows for simultaneous imports and exports of the same good.

The imperfect substitutes model is more applicable and commonly used in the relevant literature. Since this model more realistically predicts the trade patterns we see in Ghana prior to 1983, with imports and domestic production of the same goods, this paper will employ imperfect substitutes model. This model assumes the demand for exports and imports is determined by a variable of relative prices, which includes the nominal exchange rate, and an income variable. A complete derivation of the model can be found in Goldstein and Kahn (1985).

Logarithmic form in this model allows imports and exports to change proportionately to fluctuations in their arguments. This model specification is standard in other relevant literature; see Musila (2002), and Loto (2011). The import and export demand equations are specified as follows:

$$\ln(x)_t = \alpha_0 + \alpha_1 \ln(RER)_t + \alpha_2 \ln(Y^*)_t + \mu_t$$

$$\ln(m)_t = \beta_0 + \beta_1 \ln(RER)_t + \beta_2 \ln(Y)_t + \varepsilon_t$$

where

x= real value of exports of goods and services

m= real value of imports of goods and services

$$RER = \frac{eP^*}{P} = \text{real exchange rate}$$

e= nominal exchange rate

P* = foreign prices

P= domestic prices

Y*= trading partners' income

Y= domestic income

In order to estimate the real exchange rate, P will be proxied by the domestic GDP deflator. P* will be proxied by the trading partners' GDP deflator. Y* and Y are proxied by foreign and domestic GDPs, respectively.

Within the import and export demand equations, α_0 and β_0 denote the intercept terms. The coefficients of greatest interest in this model specification are α_1 and β_1 , which are the price elasticities of exports and imports, respectively. The magnitude of these coefficients is key to determining if the Marshall-Lerner-Robinson condition holds. If $|\alpha_1| + \beta_1 > 1$, then the condition holds. The hypothesis is that exports will have a positive sign, increasing as the currency is devaluated. Imports may have a positive or negative sign, depending on elasticity of demand. As Ghana is heavily reliant on imports, it is possible that the sign will be positive. As the trade deficit widens in the following decade, the Marshall-Lerner-Robinson condition should not hold. Their estimations will also indicate the extent to which imports and exports should change following a

currency devaluation. α_2 and β_2 are the income elasticities of exports and imports, respectively. These elasticities provide some insight as to how demand grows for imports or exports as the nation's income level (GDP here) rises.

Similarly, this model can be slightly modified to apply to good-specific elasticities. The RER component of the imperfect substitutes is then altered to incorporate good specific prices. P^* and P in this specification are the domestic and foreign prices for an individual good. These will be the foreign and domestic prices for cocoa in this study. β_1 is then the corresponding price elasticity for a given good. All other variables in the imperfect substitutes model remain the same for a good-specific elasticity estimation.

Since the greatest agricultural commodity and source of exports for Ghana has historically been cocoa, it is of interest to look at the price elasticities for this good. However, since an import market for cocoa in Ghana is basically nonexistent, the summation methodology used for the Marshall-Lerner-Robinson condition does not apply here. However, the export market is of greatest interest in looking at improvements in the overall trade account. Therefore, the export demand function of the imperfect substitutes model can be applied to in order to obtain a price elasticity of export demand for cocoa. Since this industry has a significant impact on Ghana's overall exports, this will allow an examination of how much a devaluation would improve cocoa exports and add to an improvement of the aggregate trade balance.

The impact of a currency devaluation on the cocoa market was expected to have both direct and indirect effects. Not only would a currency devaluation

increase cocoa exports directly by making them relatively cheaper, but it would also reduce the incentive to smuggle to bordering nations with lower cocoa prices. This would imply that more cocoa would remain in Ghana and be available for export. Therefore, the impact of a devaluation on the cocoa export market was expected to have a more significant impact on trade balance by taking both effects into account. However, it is only feasible to quantitatively measure the direct impact of a devaluation on cocoa exports with this model.

Since time series data is necessary to estimate the model, it is possible that there exists correlation in the error terms of different periods. Therefore, to correct for potential autocorrelation, the Prais-Winsten procedure is implemented, following the OLS method, to estimate the import and export price elasticities. The Durbin-Watson statistic provided with the Prais-Winsten procedure shows the extent of autocorrelation in the data before and after transformation. A low Durbin-Watson statistic near 0 indicates higher autocorrelation, and a value near 2 indicates that there is almost no autocorrelation.

3.3 Data Sources

Data sources used in this paper include the IMF's International Financial Statistics (IFS), Direction of Trade Statistics (DOTS), the Centre for the Study of African Economies (CSAE), United Nations Comtrade database and the World Bank Databank. Data was extracted from these sources for Ghana's top five major trading partners; Germany, the Netherlands, Japan, United States, and the United Kingdom. The Databank and IFS databases provide annual measures of

the GDP, GDP deflators, and nominal exchange rates for Ghana and each of its five major trading partners for years 1960-1983. The DOTS database provided annual aggregate values of exports and imports for each trading partner. Annual cocoa prices were extracted from the CSAE database. Annual bilateral cocoa export data is available from the Comtrade database.

All variables are in the Ghanaian currency. GDP is in real terms. All variables are in terms of the cedi. Trade shares were calculated for each of the trading partners in order to weight the foreign GDP deflators and the nominal exchange rates. These two weighted variables are used in the specification for the real exchange rate variable. The nominal exchange rate is measured as the amount of cedi per foreign currency.

CHAPTER IV TESTING AND RESULTS

4.1 OLS and Prais-Winsten Estimates

The first empirical test performed is the OLS procedure to estimate the aggregate import and export demand equations. The coefficients on $\ln(\text{RER})$, which are the price elasticities of interest, are used to analyze the Marshall-Lerner-Robinson Condition. The Prais-Winsten procedure is then applied to these estimates in order to correct for autocorrelation. These results are presented in Table 2. Estimation with OLS results in the following export and import demand equations:

$$\ln(\text{Imports}) = 1.55 \ln(\text{ghana_gdp}) + .180 \ln(\text{RER}) - 15.398$$

$$\ln(\text{Exports}) = .343 \ln(\text{foreign_gdp}) + .245 \ln(\text{RER}) - 6.858$$

Table 2. OLS and Prais-Winsten Estimates

	Import Demand	Export Demand	MLR Condition
OLS	.180**	.245**	.425
Prais-Winsten	.328**	.164**	.492

**p-value < .05 *p-value < .1

We can infer from the price elasticity of import demand, .180, that a 1% depreciation of the exchange rate leads to a .180% increase in the value of demand for imports. Likewise, a 1% depreciation of the cedi is estimated to increase exports by .245%. This positive import price elasticity supports the hypothesis that Ghana has a very inelastic demand for imports. We would expect that imports would decrease as the devaluates. However, although

imports have become relatively more expensive, the quantity demanded decreases very little, so that the value of goods imported actually increases. Therefore, we see the same sign for imports and exports. The Prais-Winsten estimates of these elasticities are lower and suggest a .328% and .164% change in import and export demand, respectively. These different estimates imply that the presence of autocorrelation led to over and underestimation of the price elasticities. The summation of these OLS estimated trade elasticities, .425, shows that the Marshall-Lerner-Robinson condition does not hold for Ghana. With the Prais-Winsten estimation of .492, the data is further from satisfying the Marshall-Lerner-Robinson condition, after correcting for autocorrelation.

The Prais-Winsten method was employed to correct for autocorrelation. For aggregate export demand, the Durbin-Watson statistic is initially .202 and 1.811 after transformation. For aggregate import demand, the Durbin-Watson statistic increases from .242 to 2.078 after transformation. This implies that after transformation, autocorrelation decreases significantly for export demand and there is nearly zero autocorrelation remaining in the import demand error terms.

4.2 Income Elasticities

The income elasticities, 1.55 for Ghana and .343 for foreign trade partners, indicate that GDP growth has a positive impact on Ghanaian imports and exports. Ghana's substantially larger income elasticity likely results from the much lower initial state of the GDP relative to its trading partners. In comparison to Ghana's trading partners, income has a significantly greater impact on exports

than the price elasticity. This suggests that as policy is implemented to improve economic growth, and hence the GDP, imports will see a significant increase. This effect could further worsen the trade balance when not offset by substantial improvements in exports. This relationship is reversed for export demand, suggesting pricing has a greater impact on Ghanaian exports than does the income of the trading partners. However, these top five partners are at a much greater GDP than Ghana over this period.

4.3 Bilateral Price Elasticities

With data on only the top five trading partners, it is of interest to examine differences in price elasticity estimates for each trading relationship. OLS and the Prais-Winsten procedure are employed to estimate each trading relationship. On a bilateral basis, we see the following estimates for each trading partner:

Table 3. Bilateral Price Elasticity Estimates

Country	Import Demand	Export Demand	MLR Condition
Germany	.179** (.162)	.065** (.112)	.244 (.274)
Netherlands	.311** (.107)	.378** (.314)	.689 (.421)
Japan	.072 (.063)	.336 (.107)	.408 (.170)
United Kingdom	.439 (.335)	.339* (.590)	.778 (.925)
United States	.083 (.053)	.545 (.546)	.628 (.599)

**p-value < .05 *p-value < .1
(Prais-Winsten estimates)

There is significant heterogeneity in the estimates on a bilateral basis. The estimations for the Marshall-Lerner-Robinson condition widely range. However, the estimates for the United States and Japan are not significant at the 5% or 10% level. Even the highest OLS estimate, .778, for the United Kingdom, suggests that a devaluation will not improve the trade account between Ghana and the United Kingdom. With only five partnering countries, we see a wide range of price elasticities for both imports and exports. Furthermore, the significant elasticities are substantially larger than the others. However, there is no bilateral trade relationship that the condition predicts will improve by a currency devaluation. These individual trends can be found in Appendix 1.

4.4 Panel Regression Results

Given the significant differences between country-specific elasticity estimates, it is of interest to also estimate a panel regression, applying a country fixed-effect. This procedure gives the following results:

Table 4. Panel Regression Results

	Import Demand	Export Demand	MLR Condition
Country FE	.179**	.244**	.423

**p-value < .05 *p-value < .1

This panel regression with a country fixed-effect, gives a slightly higher import demand and lower export demand price elasticity. Both estimates are significant at the 5% level. These results suggest that the Marshall-Lerner-Condition is not met with the panel regression method. Furthermore, these

estimates imply that a 1% currency devaluation will only improve the exports by .244%. Using this specification, we get a much lower estimate for the export price elasticity and higher estimate for the import price elasticity. Nevertheless, the Marshall-Lerner-Robinson condition remains significantly below 1, predicting a potentially worsening trade account following currency devaluation.

4.5 Cocoa Export Price Elasticity

OLS is used to estimate the price elasticity for the cocoa export demand. The Prais-Winsten procedure is then included to adjust for potential autocorrelation. OLS gives the following export demand equation:

$$\ln(\text{Cocoa Exp}) = -.427 + .232 \ln(\text{Cocoa RER}) + .820 \ln(\text{foreign_GDP})$$

The Prais-Winsten estimate is .241 for the price elasticity. Since cocoa imports for Ghana are negligible, this industry consistently has a trade surplus, exporting significantly more cocoa than it imports. Therefore, it is not relevant to test the Marshall-Lerner-Robinson condition specifically for the cocoa sector. However, by looking at the export price elasticity, we can see that a 1% devaluation of the cedi will increase cocoa exports by .232%. It is apparent that the industry would require a significant devaluation in order to see the sort of improvement in exports necessary to benefit the trade account.

However, the large problem with smuggling cocoa to bordering countries is interconnected with this issue. Since a devaluation of the cedi would make cocoa relatively cheaper when purchased from Ghana as opposed to bordering countries, the incentive to smuggle would lessen as overpricing was addressed.

This would further boost the cocoa export industry. Since this export price elasticity of .232 does not take this indirect factor into account, it is likely that cocoa exports would improve at a rate greater than .232% following a depreciation of the cedi.

CHAPTER V CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Given the testing conducted in this paper, elasticity estimates show that the Marshall-Lerner-Robinson condition does not predict an appreciating trade account on an aggregate or bilateral basis, following a devaluation of the cedi in 1983. This is in fact true as we look at the worsening deficit in the following decade (See Figure 1 below).

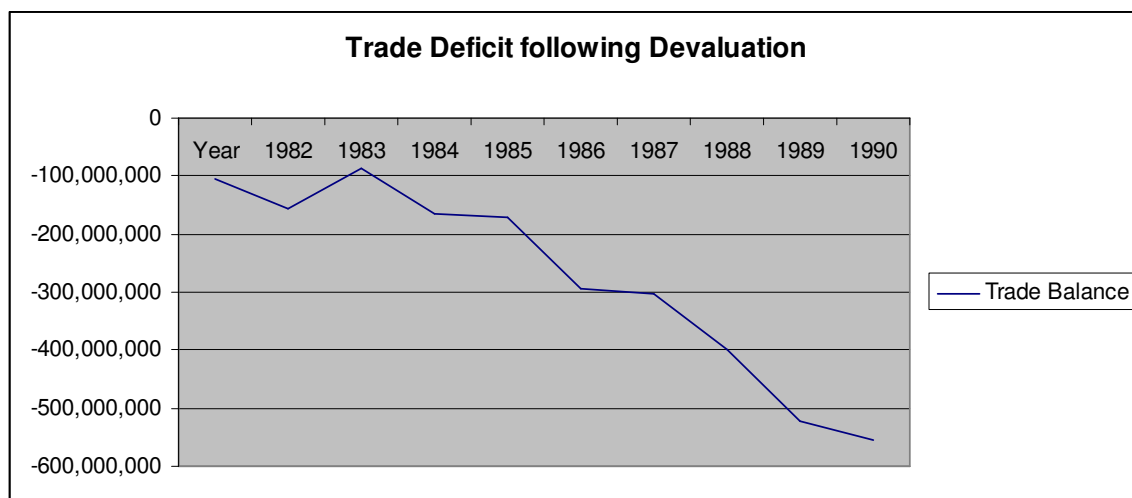


Figure 1. Trade Balance following Devaluation

Therefore, the data supports the Marshall-Lerner-Robinson condition. Relevant literature has concluded that less developed countries, and African nations in particular, are too heavily dependent on imports to improve the trade balance with currency depreciation. Rapidly growing import demand in Ghana following 1983 can likely be attributed to a large income elasticity and growing GDP. Given Ghana's high level of import dependency, this low price elasticity is

similar to those estimated in similar African economies. Reliance on imports appears to be the greatest factor in the trade deficit. The negative sign of the import price elasticity indicates that the overall expenditure on imports increases as the currency depreciates, even though imports would become relatively more expensive. This occurs when the overall volume of imports decreases, yet not enough to compensate for rising prices, where there is an inelastic demand. Even as the economy grows, a high income elasticity for imports suggests that the trade account will worsen without compensation from growth of exports. Although we see higher growth rates of exports following a depreciation of the cedi, the growth rate of imports is larger and prevents any improvement in the trade account.

It is apparent with these significantly low price elasticities that a large devaluation would be necessary to see the level of export growth needed to improve the trade account. However, with such large devaluations, inflationary pressures are common. Not only was inflation a primary issue addressed by the World Bank, when Ghana reached an inflation rate of 123% in 1983, but furthermore, inflation would also impact relative prices in a way that would combat export growth due to nominal currency devaluation. Therefore, it would not be feasible to improve the trade balance to the extent necessary without a large devaluation.

Low export price elasticities have been estimated for other African nations with similar trading patterns. Among these, low elasticities are common when the concentration of exports lies within a few primary commodities. This is true

for Ghana, particularly as cocoa has historically been the greatest source of exports. The good-specific price elasticity for cocoa is slightly larger than the aggregate price elasticity, yet would still require a significant devaluation to make an impact on the trade account. In conjunction with Babatunde and Olofin, the declining relative importance of this good in world trade as foreign competition becomes stronger, suggests that overall export performance may benefit from a greater focus on service or manufacturing goods. Although overpricing in the cocoa industry was considered a hindrance to export performance, institutional improvement and smuggling prevention may have a more beneficial effect for exports.

Overall, a devaluation of the cedi in 1983 is not justified by the Marshall-Lerner-Robinson condition. The worsening deficit in the following decade supports this prediction. As there is an estimated lag of up to two years before an improvement can be seen, we would expect to see an appreciating trade account by 1985. In this period, it is common for the trade account to worsen briefly. However, the deficit consistently worsens following this two year benchmark. Although the condition predicts a worsening deficit, this currency depreciation was only the first in a series of consecutive devaluations. Therefore, the extent of the growing deficit cannot be solely attributed to this specific cedi depreciation since it is common to see a worsening of the trade deficit before an improvement. Alternative policies to improve the trade balance would have to involve increasing the competitiveness of domestically produced goods outside of currency depreciation. This could mean a subsidy for domestic

producers which may also lessen the reliance on imports. However, addressing institutional matters, such as over taxing and charging rents to agricultural farmers, will be essential for the export market to improve and maintain growth. Furthermore, in addressing the balance of trade by way of a currency depreciation, measures should to dampen inflationary pressures as the magnitude of a necessary devaluation would be significant.

5.2 Suggestions for Further Research

Very few studies have been conducted regarding consistent devaluations versus a single depreciation. Particularly in cases where the Marshall-Lerner-Robinson condition is not met prior to a depreciation, it would be of interest to examine the trade account following a devaluation. Further research should involve a comparison of Ghana's trade deficit to that of other developing nations where there has only been a single depreciation. This may shed some light on the effect of consistent devaluations in a relatively shorter period.

Lastly, the literature, and results here indicate that concentration in agricultural commodities is prevalent among developing nations and is a major hindrance to an improvement in the trade account. Future research should investigate the extent to which elasticities differ among agriculture, manufacturing and service sectors. This may suggest which industries should be focused on in order to improve their exports more efficiently. Price elasticity changes as a nation develops may give some sort of indication as to which sectors will see the greatest improvements as a developing nation moves towards focusing in

manufacturing or service sectors. It is possible that import reliance may fall as well as these nations continue to develop.

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APPENDIX

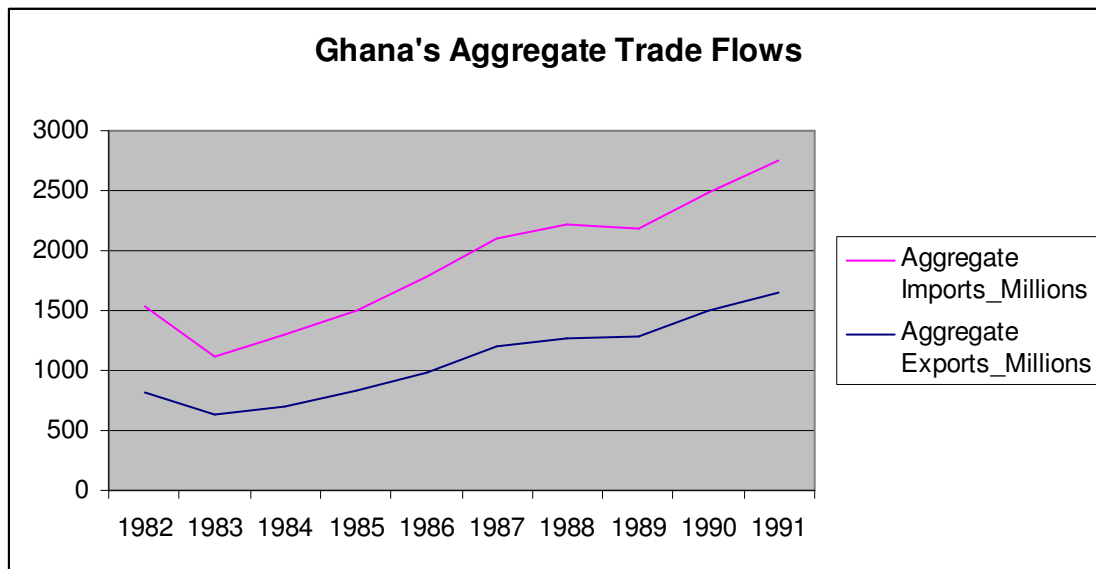


Figure 2. Aggregate Trade Flows (Post 1983)

Bilateral Aggregate Trade Flows

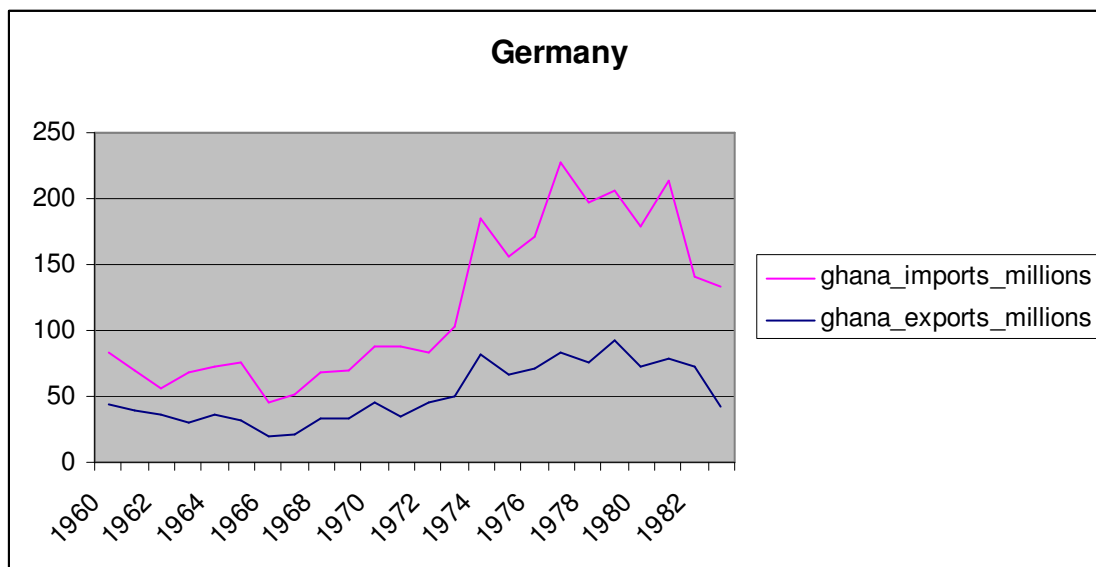


Figure 3. Bilateral Trade Flows with Germany

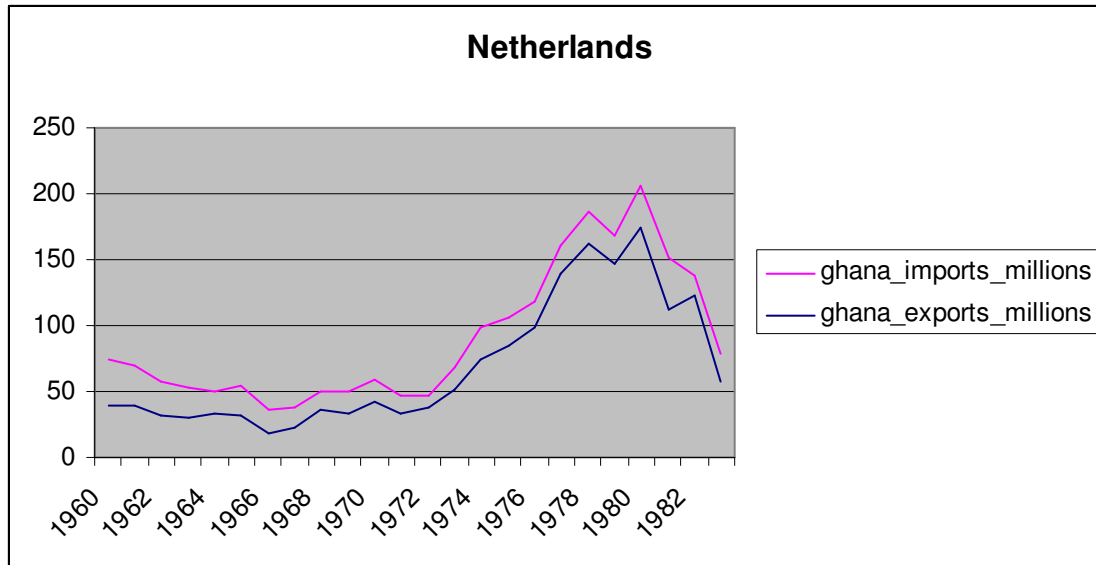


Figure 4. Bilateral Trade Flows with the Netherlands

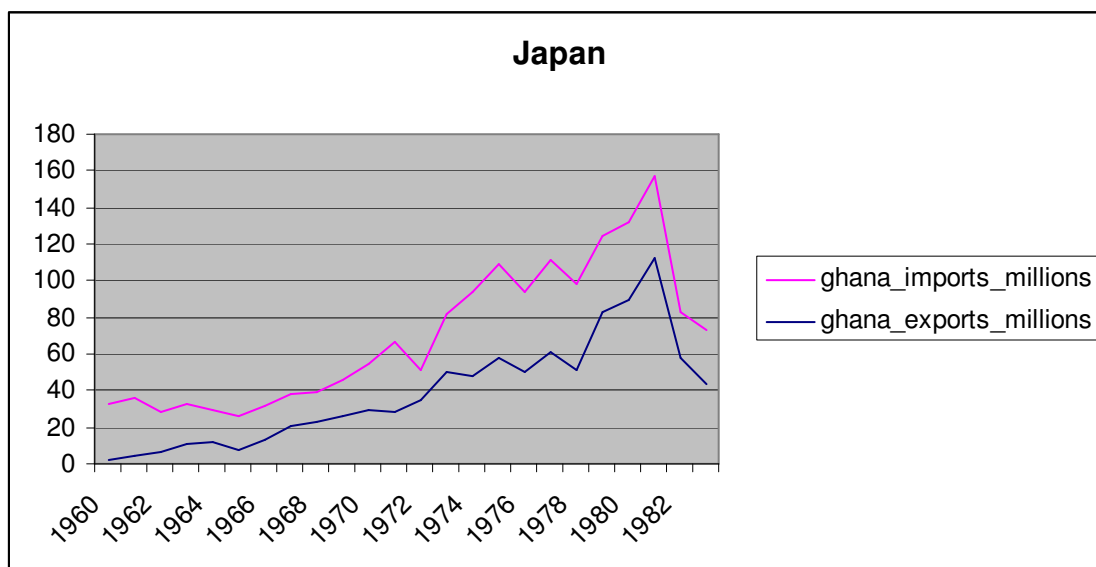


Figure 5. Bilateral Trade Flows with Japan

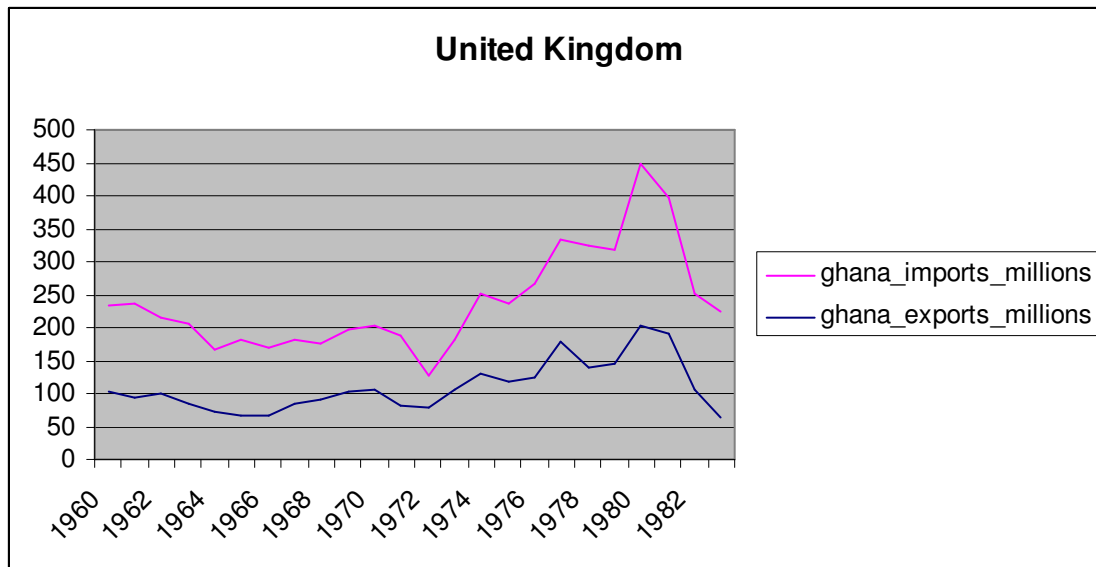


Figure 6. Bilateral Trade Flows with the United Kingdom

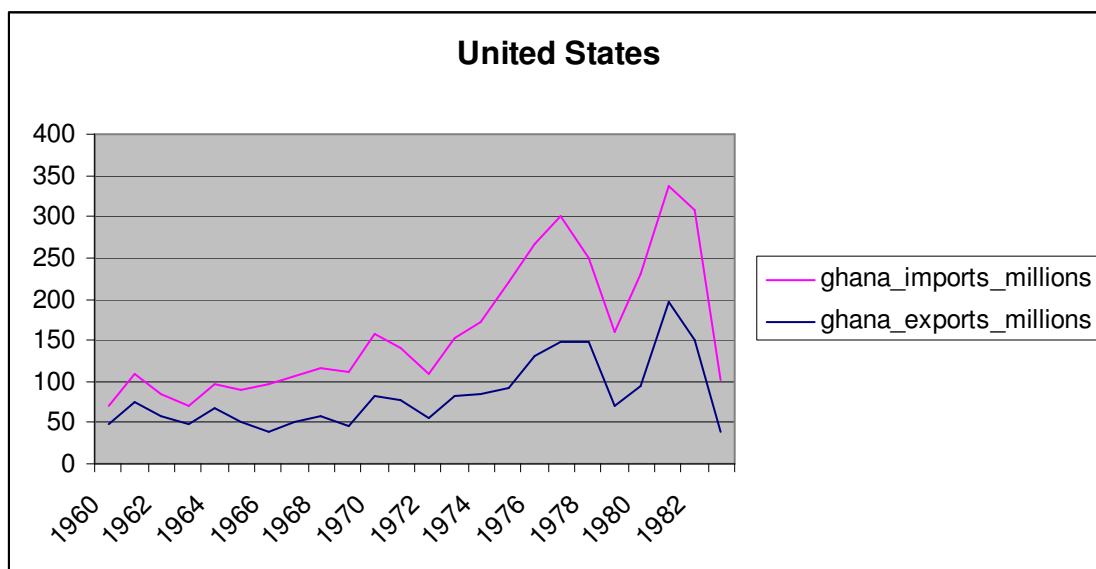


Figure 7. Bilateral Trade Flows with the United States

VITA

Judith Canipe was born in Nashville, TN to Pam and Les Canipe. She is the oldest of three children: sisters Leslie and Mary. She attended Lincoln Charter High School in Lincolnton, NC. After graduating valedictorian, she continued her education at North Carolina State University in Raleigh, NC. She completed a double major in Economics and International Studies with a minor in Statistics, receiving two Bachelor degrees summa cum laude in May, 2011. During her undergraduate career, she participated in a study abroad program to Australia and an internship with the Federal Reserve Bank. She then accepted a graduate assistantship at the University of Tennessee, Knoxville, in the Economics department. Judith graduated with a Master of Arts degree in Economics in December 2012. She is continuing her career and exploring careers in both the public and private sector.